

## CHANGES IN THE FERN FLORA OF GUNONG ULU KALI\*

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### ABSTRACT

Changes in the fern flora of Gunong Ulu Kali, Malaysia, resulting from the development there of a hill resort, are discussed. Fourteen fern species new to the mountain are recorded from near the summit, 5,814 ft (1772 m), and a further thirteen from tall montane forest at about 5,000 ft (1500 m).

### INTRODUCTION

The realisation that large areas of the natural vegetation of Gunong Ulu Kali would inevitably be destroyed during development of the Genting Highlands resort was a major reason for recording the fern flora there. A list of species occurring above 5,000 ft (1524 m) was compiled during the four years following the opening of the first hotels (Piggott, 1977). The resort, which provides recreational facilities giving pleasure to thousands of people, continues to expand. The mushroom farm was moved to a larger site on the slopes below Location F and the original site converted into a flower nursery and vegetable garden. Although the buildings remain, the new site has now been abandoned. Colourful gardens now surround the resort buildings. Exotic ornamentals have been introduced, and with them some weeds (Stone *et al.*, 1977). Development of the area has resulted in changes in habitat and, consequently, changes in the composition and distribution of the flora. Pioneer species are common in cleared areas and tangled thickets are covering the exposed edges of the forest. Many of these species were previously present only in small numbers and are now rapidly multiplying. Fourteen species new to G. Ulu Kali have been recorded along the ridge between Locations B and I, and a further thirteen along the 1500 m contour. Specimens have been deposited in the herbaria at Kew (K) and Singapore (SING). Changes in the fern flora of the different habitats occurring on the mountain are discussed in the following paragraphs.

### ROADSIDE VERGES AND DRAINS

The road along the ridge had not long been constructed when the fern flora there was first examined. Now the verges and drains have matured and weathered, and in places fallen forest debris and sand have accumulated. Previously only infrequent plants of *Christella arida* (Don) Holtt., *Nephrolepis tuberosa* (Bory) Presl, *Pteris vittata* L. and *Sphaerostephanos polycarpus* (Bl.) Holtt. were seen. These have now become common. *Equisetum debile* Roxb., first recorded as a single colony near Location C, is very common on sandy patches and small cleared areas throughout the length of the ridge. This fern ally has recently appeared at Fraser's Hill and is spreading in similar habitats.

\* q.v. "The Ferns of Gunong Ulu Kali", Gard. Bull. Sing. 30 (1977) 31-43.

New record for G. Ulu Kali: *Pseudophegopteris rectangulare* (Zoll.) Holtt. at Location E, collections 2627 (K) and 2628 (SING) of 26.10.80.

### GRANITE WALLS

Walls were necessary at several places along the ridge. The new walls were not a suitable habitat for plant growth and only occasional stunted plants of *P. vittata* and *S. polycarpus* were recorded on them. Now they have weathered a little, and debris has lodged between the granite rocks. More ferns are beginning to grow there. Three species new to the summit, but recorded at lower altitudes on G. Ulu Kali, are:

*Aglaiomorpha heraclea* (Kze.) Copel. at Location H, collections 2357 (K) and 2358 (SING) of 29.04.79.

*Drynaria rigidula* (Sw.) Bedd. at Locations B, F and H, collection 2359 (K) of 29.04.79.

*Pyrrosia floccigera* (Bl.) Ching at Location H, collections 2360 (K) and 2361 (SING) of 29.04.79.

### SMALL CLEARINGS AND GENTLE EARTH SLOPES

The acid peat surface soils and acidic subsoils (Piggott, 1978) were removed from small clearings on the ridge at the time the road was constructed, leaving more neutral, though often shallow, sandy weathered rock. These areas are being covered by carpets of *Crawfordia trinervis*, with purple berries, and thorny tangles of *Rubus moluccanus*, wild raspberry. Here *Pityrogramma calomelanos* (L.) Link, *Diplazium speciosum* Bl. and *Pteris tripartita* Sw. are frequent. Some plants of *Plagiogyria tuberculata* Copel. have also been found in this rather exposed habitat. *Pteridium aquilinum* (L.) Kuhn var. *wightianum* (Ag.) Tryon grows on the edges of the clearings. *Gleichenia hirta* Bl. var. *amoena* (v.A.v.R.) Holtt. is now quite common on some of the gentle earth slopes. Five species new to G. Ulu Kali were found in this habitat:

*Diplazium esculentum* (Retz.) Sw. at Location H, collections 2354 (K) and 2355 (SING) of 29.04.79.

*Goniophlebium subauriculatum* (Bl.) Presl at Location I, collections 2585 (K) and 2586 (SING) of 27.09.80.

*Hypolepis brooksiae* v.A.v.R. at Location H, collection 2695 (K and SING) of 01.01.81.

*Microlepia speluncae* (L.) Moore var. *hancei* (Prantl) C. Chr. at Location B, collection 2402 (K) of 14.10.79.

*M. strigosa* (Thbg.) Pr. at Location F, collection 2401 (K) of 14.10.79.

Plants matching the unidentified sterile *Microlepia* sp., collections 1175 (K) and 1176 (SING) of 09.11.74, which was under observation but lost during road improvements, have been found in the same vicinity at Location G. A few sori were produced and the species identified as *M. todayensis* Chr., collections 2352 (K) of 29.04.79, 2366 (SING) of 10.05.79 and 2644 (K) of 22.11.80.

## LARGE CLEARING AT LOCATION H

Very little plant growth has occurred in this area, mainly due to its frequent use by vehicles and as a camp site. *P. a.* var. *wightianum*, *Hypolepis beddomei* (Kunstler) Nair & Ghosh (former name: *H. punctata* (Thbg.) Mett.) and some Gleicheniaceae are growing along the outer edges.

## ROAD CUTTINGS AND EARTH BANKS

Previously infrequent and often stunted, large plants of *Blechnum orientale* L. are now not uncommon in this habitat on the ridge. *Dicranopteris curranii* Copel., *D. linearis* (Burm.) Underwood var. *linearis* Holtt. and *D. l.* var. *montana* Holtt. have covered some exposed areas. *Dipteris conjugata* Reinw. has colonised others, often in association with *Sphenomeris chinensis* (L.) Maxon var. *divaricata* (Chr.) Kramer. The deeper vertical road cuttings are not yet much colonised and only a few small plants, some of them fallen epiphytes, have appeared in cracks and erosion gulleys.

## MOSSY BANKS ABOVE ROAD CUTTINGS

The mossy peat rootmat of the floor of the dwarf forest has been exposed along the top of earth cuts. Where erosion has occurred it overhangs and is well-drained, supporting colonies of *Gleichenia vulcanica* Bl., *Coryphopteris gymnopoda* (Bak.) Holtt. and *C. g.* var. *bintangensis* Holtt. The two varieties of *C. gymnopoda* are present in about equal numbers in this habitat, together with apparently intermediate forms. In shade the plants produce rosettes of fronds, but on exposed rootmats this character is less evident. The fronds appear evenly distributed and assume a drooping habit, although not wilted.

## EDGE OF FOREST

Fern growth along the exposed edges of the forest is similar to that occurring in upland areas throughout West Malaysia, and consists mainly of thicket-forming species. Along the ridge these are *G. longissima* Bl., *G. truncata* (Willd.) Spr. var. *plumaeformis* (Presl) Holtt. and *Histiopteris incisa* (Thbg.) J. Sm. In several places *G. vulcanica* has also formed delicate miniature thickets. Although trunk growth in Cyatheaceae is slow and few tall tree ferns can yet be seen in this habitat, fronds of *Cyathea contaminans* (Wall. ex Hook.) Copel. are now penetrating the thickets. At lower altitudes, along the road from Genting Simpah to the hotels, tall tree ferns of this species are common on the edge of the forest. *Pyrrosia floccigera* was recorded as an epiphyte in an exposed position on the edge of the forest at Location E.

## DWARF FOREST

The less accessible areas of the ridge forest are still relatively undisturbed. Where access is fairly easy, the forest has been penetrated by footpaths and camp sites have been cleared. Culverts, constructed when the road was built, have improved the drainage of the highest parts of the forest. The habitat has become drier and many of the small delicate epiphytes are now less abundant. Whereas previously many trees were clothed with Hymenophyllaceae, it is now necessary to hunt for them in the shelter of the remaining wet mossy hollows. *Phymatopteris laciniata* (Presl) Pic. Ser. (former name: *Crypsinus laciniatus* (Presl) Holtt.) now appears to be more abundant, often on the higher branches of the trees. *Matonia pectinata* R. Br. has spread where the dwarf forest has been 'thinned' and become more open. Four small fern epiphytes new to G. Ulu Kali were collected:

*Calymmodon gracilis* (Fee) Copel. at Location E, collection 2630 (K) of 26.10.80.

*Grammitis hirtella* (Bl.) Tuyama var. *coriacea* at Location F, collection 2440 (K) of 21.11.79.

*Scleroglossum debile* (Kuhn) v.A.v.R. at Locations B and I, collections 2568 (K) of 22.03.80 and 2632 (SING) of 26.10.80.

*Trichomanes digitatum* Swartz at Location I, collection 2633 (K and SING) of 26.10.80.

#### ROAD TO WESTERN DAM, LOCATION L

During his visit to Malaysia in 1978, Dr. R. E. Holttum collected specimens of *Chingia perrigida* (v.A.v.R.) Holtt., growing in fairly open scrub at 5,000 ft (1524 m). Earlier specimens from the same place had been incorrectly named *C. pseudoferox* Holtt. This is a new record for W. Malaysia.

#### STEEP SLOPE WITH BOULDERS

The sheltered area southeast of 'Sri Genting' had not previously been fully investigated. Here, a little above the 5,000 ft contour, tall forest covers a steep slope. There are piles of large granite boulders, and small, wet, deeply shaded valleys. Many of the tree trunks are mossy. This area is relatively undisturbed except along the line of the cable-car route. A form of *P. laciniata*, differing in appearance from the same species in other locations on the mountain, was frequent on mossy trees and rocks. The pendent fronds, thin but firm, were glaucous above and very glaucous below. Most fronds were simple or trilobed, and many were fertile. *Oleandra pistillaris* (Sw.) C. Chr. on mossy boulders exhibited a creeping habit rather than the usual shrubby growth. Filmy ferns were common on mossy trunks and rocks. The following fern species, collected from this location, are new to G. Ulu Kali:

*Asplenium affine* Sw., collection 2497 (K) of 13.01.80.

*Diplazium malaccense* Presl, collection 2495 (K) of 13.01.80.

*D. subintegrum* (Holtt.) Holtt., collections 2424 (K), 2425 (SING), 2427 (K) and 2428 (SING) of 04.11.79.

*D. tomentosum* (Bl.) Milde, collections 2429 (K) and 2430 (SING) of 04.11.79.

*Elaphoglossum callifolium* (Bl.) Moore, collection 2500 (K) of 13.01.80.

*Hymenophyllum denticulatum* Sw., collection 2453 (K) of 02.12.79.

*H. polyanthus* Swartz, collection 2457 (K) of 02.12.79.

*Phymatopteris triloba* (Houtt.) Pic. Ser. (former name: *Crypsinus trilobus* (Houtt.) Copel.), collection 2464 (K) of 02.12.79.

*Trichomanes idoneum* Morton, collection 2455 (K) of 02.12.79.

*T. maximum* Bl., collection 2465 (K) of 02.12.79.

*T. proliferum* Bl., collection 2461 (K) of 02.12.79.

*T. saxifragoides* Presl, collection 2444 (K) of 02.12.79.

### CONCLUSION

The genera *Calymmodon*, *Grammitis*, and *Scleroglossum* are mostly epiphytes of mossy trees in mountain forest. Some species had already been recorded on G. Ulu Kali. *C. gracillis*, *G. hirtella* var. *coriacea*, and *S. debile* have been little collected in W. Malaysia but their occurrence in dwarf forest on the ridge could be expected. *T. digitatum* is not common but has been found on mossy trees at lower altitudes in the mountains and also on mangrove trees in the southern part of the peninsula.

*Aglaomorpha heraclea* and *Pyrrosia floccigera* are fairly common epiphytes of mountain forest to about 4,000 ft (1,220 m) and have been recorded at that altitude nearby. *Drynaria rigidula* is widely distributed, but not common, in the northern half of the peninsula. It occurs at Fraser's Hill, only about 20 miles (32 Km) to the north, and also on the lower southern slopes of G. Ulu Kali. It is not, therefore, unlikely that spores could be carried to these higher altitudes and lodge in positions suitable for successful germination.

*Diplazium esculentum* is a fern of wet ground in open places in the lowlands. Although the author has recorded this species at Fraser's Hill and also near the southern end of the Main Range, its occurrence on the ridge was quite unexpected. *Microlepia speluncae* var. *hancei* is again predominantly a lowland fern, but has occasionally been collected in the mountains. Neither *M. strigosa* nor *M. todayensis* is common in W. Malaysia, although both occur in a few places in the mountains. *Goniophlebium subauriculatum*, *Hypolepis brooksiae*, and *Pseudophegopteris rectangulare* are all species which become common in mountain clearings, such as occur at Cameron Highlands and Fraser's Hill. Only a single large plant of *G. subauriculatum* and one small colony of *P. rectangulare* were recorded, but both were sporing profusely and could be expected to spread.

The twelve species new to G. Ulu Kali collected from tall sheltered forest near 'Sri Genting' are not uncommon in W. Malaysia, and have been collected from similar situations elsewhere. But *Chingia perrigida* is only otherwise known from central and southern Sumatra and Java at 5,000 – 8,500 ft (1500 – 2600 m) (Holtum, 1981).

Many of the fern species found on G. Ulu Kali are common in W. Malaysia, some at a wide range of altitudes, others only in the mountains. Several are confined to high mountains with dwarf forest frequently in cloud. A few species have not been recorded elsewhere in W. Malaysia but probably occur on botanically unexplored mountains, and are known to occur in other countries. The only species which might possibly be endangered is *Elaphoglossum robinsonii*, known only from G. Ulu Kali and nearby G. Mengkuang; but even this is not in danger of becoming extinct. It is now growing in the Fern House of the Royal Botanic Gardens at Kew, and spores have also been distributed to pteridologists for propagation in other parts of the world.

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Plate 1. *Pteridium aquilinum* (L.) Kuhn var. *wightianum* (Ag.) Tyron growing in the crack of a granitic outcrop.



Plate 2. *Christella arida* (Don) Holtt. growing in sand and debris which has accumulated in a roadside drain.



Plate 3. *Equisetum debile* Roxb. on an eroding roadside bank.



Plate 4. *Plagiogyria tuberculata* Copel., *Coryphoteris gymnopoda* (Bak.) Holtt., *Gleichenia vulcanica* Bl., and *Diplazium speciosum* Bl. growing on an exposed earth slope.

Plate 5. *Cyathea contaminans* (Wall. ex Hook.) Copel. penetrating thickets at the edge of the forest, c. 1524 m.



Plate 6. *Gleichenia longissima* Bl., *Matonia pectinata* R. Br., and *Dipteris conjugata* Reinw. (left to right) in a "thinned" dwarf forest.

